

[CLAIMS

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1. A method for processing a microelectronic substrate, comprising:

disposing an electrolytic fluid adjacent to a conductive material of the microelectronic substrate, the conductive material having a first surface in a first plane and a recess in the first surface, the recess being bounded by a second surface in a second plane, the conductive material further having a corner between the first and second surfaces; and

removing at least part of the conductive material from the corner by positioning first and second electrodes in fluid communication with the electrolytic fluid and coupling at least one of the electrodes to a source of electrical potential.

2. The method of claim 1 wherein the microelectronic substrate has a face surface and the recess extends generally transverse to the face surface, further wherein removing at least part of the conductive material includes positioning two electrodes to face toward the face surface, coupling at least one of the electrodes to a source of electrical potential, and disposing an electrolytic fluid between the face surface and the electrodes.

3. The method of claim 1, further comprising:
emitting electrical signals from an electrode spaced apart from the microelectronic substrate;

receiving the electrical signals at the corner of the conductive material;

oxidizing at least part of the conductive material at the corner by passing the electrical signals through the conductive material; and

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exposing an oxidized portion of the conductive material to a chemical etchant.

4. The method of claim 1 wherein the first surface of the conductive material is positioned proximate to a generally non-conductive material, with the generally non-conductive material positioned between the first surface and at least one of the electrodes, and wherein removing at least part of the conductive material from the corner includes removing conductive material engaged with the generally non-conductive material.

5. The method of claim 1, further comprising:
disposing a generally non-conductive layer on the conductive material; and
removing at least part of the non-conductive layer to expose the corner of the conductive material before removing at least part of the conductive material from the corner.

6. The method of claim 1, further comprising:
disposing an oxide layer on the conductive material;
disposing a nitride layer on the oxide layer; and
removing at least part of the nitride layer and part of the oxide layer to expose the corner of the conductive material before removing conductive material from the corner.

7. The method of claim 1 wherein removing the conductive material includes oxidizing at least a portion of the conductive material by passing electrical current through the portion, and exposing the portion to an etchant.

8. The method of claim 1, further comprising selecting the electrolyte to include water and at least one of hydrochloric acid and hydrofluoric acid.

9. The method of claim 1 wherein removing at least part of the conductive material includes passing electrical current into the conductive material at a rate of from about one to about 500 milliamps per square centimeter.

10. The method of claim 1 wherein removing at least part of the conductive material includes selecting the source of electrical potential to provide about 15 volts_{rms} to the conductive material.

11. The method of claim 1 wherein removing at least part of the conductive material includes selecting a current passing through the conductive material to vary at approximately 60 Hz.

12. The method of claim 1 wherein removing at least part of the conductive material includes selecting a current passing through the conductive material to be an alternating current.

13. The method of claim 1, further comprising selecting the electrolytic fluid to include water, hydrochloric acid, and hydrofluoric acid in a ratio of about 500:1:1.

14. The method of claim 1, further comprising selecting the conductive material to include doped silicon.

15. The method of claim 1, further comprising selecting at least one of the first and second electrodes to include at least one of platinum, tantalum and graphite.

16. The method of claim 1, further comprising positioning at least one of the first and second electrodes a distance of from about one millimeter to about two millimeters from the microelectronic substrate.

17. The method of claim 1, further comprising disposing an insulating layer on walls of the recess after removing material from the corner.

18. The method of claim 1, further comprising disposing a dielectric material in the recess.

19. The method of claim 1 wherein removing at least part of the conductive material includes reducing a rate at which the conductive material is removed from the corner by rounding the corner.

20. A method for processing a microelectronic substrate, comprising:

disposing a generally non-conductive material adjacent to a conductive material of the microelectronic substrate;

forming a recess extending through the generally non-conductive material and into the conductive material, the recess defining a corner at least proximate to an interface between the conductive material and the generally non-conductive material; and

removing at least part of the conductive material from the corner to at least partially blunt the corner by exposing the corner to an electrical potential.

21. The method of claim 20 wherein removing at least part of the conductive material includes positioning a first electrode and a second electrode proximate to and spaced apart from the microelectronic substrate, coupling at least one of the electrodes to a source of electrical potential, passing an electrical current

from at least one of the electrodes to the corner to oxidize conductive material at the corner, and exposing oxidized conductive material at the corner to an etchant.

22. The method of claim 20, further comprising:
emitting electrical signals from an electrode spaced apart from the microelectronic substrate;
receiving the electrical signals at the corner of the conductive material;
oxidizing at least part of the conductive material at the corner by passing the electrical signals through the conductive material; and
exposing an oxidized portion of the conductive material to a chemical etchant.

23. The method of claim 20 wherein removing at least part of the conductive material from the corner includes removing conductive material engaged with the generally non-conductive material.

24. The method of claim 20, further comprising removing at least part of the non-conductive material to expose the corner of the conductive material before removing at least part of the conductive material from the corner.

25. The method of claim 20, further comprising:
disposing an oxide layer on the conductive material;
disposing a nitride layer on the oxide layer; and
removing at least part of the nitride layer and part of the oxide layer to expose the corner of the conductive material before removing at least part of the conductive material from the corner.

26. The method of claim 20 wherein removing the conductive material includes oxidizing at least a portion of the conductive material by passing electrical current through the portion, and exposing the portion to an etchant.

27. The method of claim 20 wherein removing at least part of the conductive material includes passing electrical current into the conductive material at a rate of about 100 milliamps.

28. The method of claim 20, wherein removing at least part of the conductive material includes passing electrical current into the conductive material at a potential of about 15 volts rms.

29. The method of claim 20 wherein removing at least part of the conductive material includes passing a current through the conductive material at a frequency of approximately 60 Hz.

30. The method of claim 20 wherein removing at least part of the conductive material includes selecting a current passing through the conductive material to be an alternating current.

31. The method of claim 20, further comprising selecting the conductive material to include doped silicon.

32. The method of claim 20, wherein removing at least part of the conductive material includes positioning first and second electrodes in fluid communication with the corner, coupling at least one of the electrodes to a source of electrical potential, and selecting at least one of the first and second electrodes to include at least one of platinum, tantalum and graphite.

33. The method of claim 20, further comprising disposing an insulating layer on walls of the aperture after removing material from the corner.

34. The method of claim 20, further comprising forming a transistor gate in the recess.

35. The method of claim 20 wherein the microelectronic substrate has a face surface and the recess extends generally transverse to the face surface, further wherein removing at least part of the conductive material includes positioning two electrodes to face toward the face surface, coupling at least one of the electrodes to a source of electrical potential, and disposing an electrolytic fluid between the face surface and the electrodes.

36. The method of claim 20, further comprising reducing a rate at which material is removed from the corner by rounding the corner.

37. A method for processing a microelectronic substrate, comprising:

forming an oxide layer on a doped silicon material of the microelectronic substrate;

disposing a nitride layer on the oxide layer;

etching a recess through the nitride layer and the oxide layer and into the conductive material;

removing a portion of the nitride layer and the oxide layer proximate to the recess to expose a corner of the conductive material;

disposing an electrolytic fluid adjacent to the corner of the conductive material;

oxidizing at least part of the conductive material at the corner by positioning first and second electrodes proximate to and spaced apart from the

microelectronic substrate and in fluid communication with the electrolytic fluid, and coupling at least one of the electrodes to a source of electrical potential; and

removing at least part of the oxidized material by exposing the oxidized material to an etchant; and

reducing a rate at which material is removed from the corner by rounding the corner to reduce a flow of electrical current from the at least one electrode to the corner.

38. The method of claim 37, wherein removing a portion of the nitride layer and the oxide layer proximate to the recess includes removing material from the nitride layer at a first rate and removing material from the oxide layer at a second rate, with the first rate approximately equal to the second rate.

39. The method of claim 37, further comprising removing the oxide layer and the nitride layer with an etchant after removing at least part of the oxidized material.

40. The method of claim 37 wherein removing a portion of the nitride layer and the oxide layer proximate to the recess includes disposing an etchant adjacent to the nitride layer and the oxide layer, with the etchant having a chemical composition approximately the same as a chemical composition of the electrolytic fluid.

41. A method for processing a microelectronic substrate, comprising:

forming a recess in a conductive material of the microelectronic substrate, the recess defining a corner at an intersection of the aperture and a plane of the conductive material;

forming a conductive microelectronic feature in the recess; and

controlling electromagnetic emanations from the conductive microelectronic feature by rounding the corner defined by the recess, wherein rounding the corner includes electrically coupling a source of electrical potential to the corner to oxidize the conductive material, and removing oxidized material from the corner by exposing the oxidized material to an etchant.

42. The method of claim 41 wherein forming a recess in a conductive material includes forming a recess in a semiconductor material.

43. The method of claim 41 wherein rounding the corner includes positioning a first electrode and a second electrode proximate to and spaced apart from the microelectronic substrate, coupling at least one of the first and second electrodes to a source of electrical potential, passing an electrical current from at least one of the first and second electrodes through an electrolytic fluid to the corner to oxidize conductive material at the corner, and exposing oxidized conductive material at the corner to an etchant.

44. The method of claim 41, further comprising:
emitting electrical signals from an electrode spaced apart from the microelectronic substrate;
receiving the electrical signals at the corner of the conductive material;
oxidizing at least part of the conductive material at the corner by passing the electrical signals through the conductive material; and
exposing an oxidized portion of the conductive material to a chemical etchant.

45. The method of claim 41 wherein the conductive material is positioned proximate to a generally non-conductive material, with the generally non-conductive material positioned between the plane of the conductive material

and at least one electrode, and wherein removing at least part of the conductive material from the corner includes removing conductive material engaged with the generally non-conductive material.

46. The method of claim 41, further comprising:
disposing a non-conductive layer on the conductive material; and
removing at least part of the non-conductive layer to expose the corner of the conductive material before removing at least part of the conductive material from the corner.

47. The method of claim 41, further comprising:
disposing an oxide layer on the conductive material;
disposing a nitride layer on the oxide layer; and
removing at least part of the nitride layer and part of the oxide layer to expose the corner of the conductive material before removing at least part of the conductive material from the corner.

48. The method of claim 41, further comprising selecting the conductive material to include doped silicon.

49. The method of claim 41, further comprising disposing an insulating layer on walls of the recess after rounding the corner.

50. The method of claim 41, further comprising forming a transistor gate in the recess.

51. The method of claim 41 wherein the microelectronic substrate has a face surface and the recess extends generally transverse to the face surface, further wherein rounding the corner includes positioning two electrodes to face toward the face surface, coupling at least one of the electrodes to a source of

electrical potential, and disposing an electrolytic fluid between the face surface and the electrodes.

52. A microelectronic substrate formed by a process, comprising:
disposing a generally non-conductive material adjacent to a conductive material of the microelectronic substrate;

forming a recess extending through the generally non-conductive material and into the conductive material, the recess defining a corner at least proximate to an interface between the conductive material and the generally non-conductive material; and

removing at least part of the conductive material from the corner to at least partially blunt the corner by exposing the corner to an electrical potential.

53. The microelectronic substrate of claim 52 wherein removing at least part of the conductive material includes positioning a first electrode and a second electrode proximate to and spaced apart from the microelectronic substrate, coupling at least one of the electrodes to a source of electrical potential, passing an electrical current from at least one of the electrodes to the corner to oxidize conductive material at the corner, and exposing oxidized conductive material at the corner to an etchant.

54. The microelectronic substrate of claim 52 wherein the process further comprises:

emitting electrical signals from an electrode spaced apart from the microelectronic substrate;

receiving the electrical signals at the corner of the conductive material;

oxidizing at least part of the conductive material at the corner by passing the electrical signals through the conductive material; and

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exposing an oxidized portion of the conductive material to a chemical etchant.

55. The microelectronic substrate of claim 52 wherein removing at least part of the conductive material from the corner includes removing conductive material engaged with the generally non-conductive material.

56. The microelectronic substrate of claim 52 wherein the process further comprises removing at least part of the non-conductive material to expose the corner of the conductive material before removing at least part of the conductive material from the corner.

57. The microelectronic substrate of claim 52 wherein the process further comprises:

disposing an oxide layer on the conductive material;

disposing a nitride layer on the oxide layer; and

removing at least part of the nitride layer and part of the oxide layer to expose the corner of the conductive material before removing at least part of the conductive material from the corner.

58. The microelectronic substrate of claim 52 wherein removing the conductive material includes oxidizing at least a portion of the conductive material by passing electrical current through the portion, and exposing the portion to an etchant.

59. The microelectronic substrate of claim 52 wherein the process further comprises selecting the conductive material to include doped silicon.

60. The microelectronic substrate of claim 52 wherein removing at least a portion of the conductive material includes selecting a current passing through the conductive material to be an alternating current.

61. The microelectronic substrate of claim 52 wherein the process further comprises disposing an insulating layer on walls of the recess after removing material from the corner.

62. The microelectronic substrate of claim 52 wherein the process further comprises forming a transistor gate in the recess.

63. The microelectronic substrate of claim 52 wherein removing at least part of the conductive material includes positioning two electrodes to face toward a face surface of the microelectronic substrate, coupling at least one of the electrodes to a source of electrical potential, and disposing an electrolytic fluid between the face surface and the electrodes.

64. A microelectronic substrate formed by a process, comprising:
disposing an electrolytic fluid adjacent to a conductive material of the microelectronic substrate, the conductive material having a first surface in a first plane and a recess in the first surface, the recess being bounded by a second surface in a second plane, the conductive material further having a corner between the first and second surfaces; and

removing at least part of the conductive material from the corner by positioning first and second electrodes in fluid communication with the electrolytic fluid and coupling at least one of the electrodes to a source of electrical potential.

65. The microelectronic substrate of claim 64 wherein the recess extends generally transverse to a face surface of the microelectronic substrate, and wherein removing at least part of the conductive material includes positioning two

electrodes to face toward the face surface of the microelectronic substrate, coupling at least one of the electrodes to a source of electrical potential, and disposing an electrolytic fluid between the face surface and the electrodes.

66. The microelectronic substrate of claim 64 wherein the process further comprises:

emitting electrical signals from at least one of the electrodes with the electrode spaced apart from the microelectronic substrate;

receiving the electrical signals at the corner of the conductive material;

oxidizing at least part of the conductive material at the corner by passing the electrical signals through the conductive material; and

exposing an oxidized portion of the conductive material to a chemical etchant.

67. The microelectronic substrate of claim 64 wherein the first surface of the conductive material is positioned proximate to a generally non-conductive material, with the generally non-conductive material positioned between the first surface and at least one of the electrodes, and wherein removing at least part of the conductive material from the corner includes removing conductive material engaged with the generally non-conductive material.

68. The microelectronic substrate of claim 64, further comprising:
disposing an oxide layer on the conductive material;
disposing a nitride layer on the oxide layer; and
removing at least part of the nitride layer and part of the oxide layer to expose the corner of the conductive material.

69. The microelectronic substrate of claim 64 wherein removing the conductive material includes oxidizing at least a portion of the conductive

material by passing electrical current through the portion, and exposing the portion to an etchant.

70. The microelectronic substrate of claim 64 wherein removing at least part of the conductive material includes selecting a current passing through the conductive material to be an alternating current.

71. The microelectronic substrate of claim 64, further comprising forming a transistor gate in the aperture.

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